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Assessing the alignment of national-level adaptation plans to the Paris Agreement

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ABSTRACT

The Paris Agreement commits state parties to a global adaptation goal and the inclusion of adaptation into their National Communications. This requires national level planning, monitoring and reporting and methods for effective global-scale adaptation tracking. However, unlike mitigation, where clear targets and goals have been agreed, adaptation is a process with varied and changing goals and risk context. Assessing adaptation plans and strategies can provide valuable insights into ongoing adaptation policy, because the plans give good indications of priorities and institutional thinking. To assess how adaptation planning aligns to the Paris Agreement, this paper used Article 7 of the agreement to develop criteria and applied these to assess national adaptation plans and strategies available in English from 36 least developed, 8 developing and 10 developed countries. The results suggest that adaptation planning aligned to the Paris Agreement can help bring a different focus to development pathways that promotes synergies rather than trade-offs between environmental, social and economic goals. Importantly, tracking adaptation planning can help ensure the continued mobilisation of the parties, guide adaptation planning nationally and locally, and support global-scale consistency in planning and action.

1. Introduction

Adaptation to climate change is increasingly important as the irreversible impacts of climate change continue to grow (Archer et al., 2009; Hoegh-Guldberg et al., 2018; Solomon et al., 2009). Mitigation has traditionally been the major focus of international negotiations on climate change given that the main objective of the United Nations Framework Convention on Climate Change (United Nations, 1992) is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Paris Agreement received widespread attention for its clear commitment to significantly mitigate greenhouse gas emissions (Kinley, 2017), although action remains uncertain and sensitive to political changes (Clemencon, 2016; Höhne et al., 2017). In contrast, adaptation has typically received less attention than mitigation in UNFCCC deliberations (Khan and Roberts, 2013). However, as the impacts of climate change have become clearer and the scope of necessary actions better understood (Solomon et al., 2009), adaptation has received increasing attention in policy, practice and research. The Paris Agreement commits state parties to a global adaptation goal and the inclusion of adaptation into their National Communications (Helgeson and Ellis, 2015; Magnan and Ribera, 2016; UNFCCC, 2016). This requires national level planning, monitoring and reporting and methods for effective global-scale adaptation tracking (Craft and Fisher, 2016; Ford et al., 2015). The 2017 Conference of the Parties in Bonn (CoP 23) saw various adaptation-related convention items discussed, such as progress in the Nairobi Work Programme (SBSTA 47) to support national adaptation planning, the role of the Adaptation Fund, and how to track, monitor and report on the agreed outcomes from Paris including the global goal on adaptation.

Assessing or measuring adaptation 'success' on a global scale is a different challenge compared to mitigation success. In light of the Paris Agreement, mitigation now has a clear goal for assessing success: holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. In contrast, adaptation is a process with varied and changing goals and risk context. Hence, it is much harder to define a similar 'final outcome' for adaptation – there is no clear, universal measure nor a point in time when it can be said that, globally, adaptation to climate change has been achieved. Rather, given that climate effects of CO_2 releases to the atmosphere will persist for decades to centuries into the future (Archer

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et al., 2009), it is likely that adaptation will have to be an ongoing, 'forever' activity. Thus, while there is significant discussion about approaches, adaptation monitoring and evaluation is harder to perform at any scale; local, project level, national or global level (Christiansen et al., 2018; Craft and Fisher, 2016; Magnan, 2016; Magnan and Ribera, 2016). Hence, global-level adaptation assessment is more heavily reliant on assessing the processes that are undertaken as part of adaptation, with an assumption that these processes and associated outcomes will increase the likelihood that adaptation is advanced globally (Craft and Fisher, 2016). Importantly, tracking adaptation planning at this level can help ensure the continued mobilisation of the parties, guide adaptation planning nationally and locally, and support global-scale consistency in planning and action.

Assessing adaptation plans and strategies can provide valuable insights into ongoing adaptation policy but studies comparing plans tend to focus on developed countries and local level action (Aguiar et al., 2018; Araos et al., 2016; Biesbroek et al., 2010; Mullan et al., 2013). The Paris Agreement lays out a set of commitments and guidelines for adaptation efforts in Article 7. To date, however, there has not been an assessment of the extent current national adaptation plans are aligned with Article 7 or discussion of what Article 7 might mean for adaptation planning.

This paper seeks to fill these two gaps by developing criteria based on Article 7 to assess plans and strategies available in English language from least developed, developing and developed countries. The plans are important for institutions and organisations as they give good indications of priorities and institutional thinking. Assessing the plans, therefore, according to criteria developed from the Paris Agreement can help track how national priorities and thinking reflect or contrast with the international agenda. The paper addresses the question 'How do national level planning documents currently align with the Paris Agreement on adaptation?' and in doing so considers how national priorities and institutional thinking might change to better reflect international commitments.

The paper is organised as follows: the next section reviews adaptation planning and international policy and explains how adaptation tracking has changed. The third section explains the methods used to assess national adaptation plans and strategies and to compare these assessments with national level data on vulnerability and other socio-economic indicators, while the fourth section presents the results of these assessments. This is followed by a discussion of the results, including the implications for implementation of Article 7 at international and national levels and recommendations for how this process could be improved. The paper ends with conclusions and suggestions for further research in this area.

2. Background

2.1. Adaptation and international policy

The agreements arising from the annual Conference of the Parties (CoP) provide a history of how adaptation, and adaptation tracking, has evolved as a policy issue within the UNFCCC process (Fig. 1). Thus, the importance of adaptation has increased over the last 30 plus years with it being gradually and more substantially included in the negotiated outcomes (Christiansen et al., 2018). Efforts to track adaptation have only recently begun to consider how national planning might be monitored, reported and compared at an international level as part of the Nationally Determined Contribution (NDC) process.

The original Convention included reference to Parties taking account of adaptation and recognising the particular vulnerability of nations to various impacts such as sea-level rise, but gave no guidance on how adaptation might be designed nor tracked (United Nations, 1992). Three key outcomes for adaptation from the UNFCCC negotiations were (1) the Least Developed Countries (LDC) Work Programme in Marrakesh CoP 7 in 2001, (2) Nairobi Work Programme (NWP) CoP 12 in 2006, and (3) the Cancun Adaptation Framework (CAF) in CoP 16 in 2010 (UNFCCC, 2014a). These mechanisms focus on enabling adaptation in developing country contexts, which reflects the prevailing view of adaptation being more an issue for developing countries than for developed ones. National Adaptation Programmes of Actions (NAPAs)[1] initiated at COP7 in 2001 as part of the LDC Work Programme ("Marrakesh Agreement to the United Nations Framework Convention on Climate Change," 2001) were designed to focus on urgent adaptation needs of the Least Developed Countries (LDCs). To date, 39 LDCs have developed NAPAs (UNFCCC, 2014b). The focus on tracking adaptation at this stage was how to identify and prioritise adaptation needs. In Marrakesh, the focus became the LDCs, with adaptation becoming closely tied to development. Although some of these countries are at the frontline of the biophysical impacts of climate change, the focus was on the lack of capacity to respond, combined with the political driver of poorer countries seeking support from wealthier countries, for a variety of reasons.[2] As a result, LDC has become a sort of shorthand for most vulnerable, even if this label this is over-simplistic and potentially unhelpful (Barnett, 2017). The NAPA process specifically helped LDCs assess their priorities through a set of criteria and list of potential adaptation actions. This process was largely country-driven, with guidance and resources mobilised by the UN but with limited guidance at an international level on how to prioritise or track the adaptation actions chosen by each country.

The Nairobi Work Programme (NWP) introduced in CoP 12 (2006) made impacts, vulnerability and adaptation its key priorities, with the establishment of the Adaptation Knowledge Portal to share knowledge and lessons learned around adaptation. The focus for tracking was on assessing impacts and vulnerability. The following Bali Roadmap (CoP 13, 2007) and the Bali Action Plan had adaptation as a separate pillar but with a rather broad definition (Harmeling and Bals, 2008). The operationalisation of the Adaptation Fund at CoP 13, after the framework had been agreed at CoP 7, included agreement to evaluate and audit activities supported by the Fund, resulting in a need for indicators for the monitoring and evaluation of funded adaptation actions. Currently, the Adaptation Fund, and similar funds such as the GEF and GCF, use a combination of quantitative and qualitative indicators, e.g.: number of beneficiaries; percentage of households having more secure access to livelihood assets; percentage of population aware of adverse impacts of climate change; capacity of staff to respond; and integration of climate change into national policies (Christiansen et al., 2018).

The Copenhagen Accord that emerged from CoP 15 (2009) had little new to say on adaptation. In contrast, the following CoP at Cancun (CoP 16, 2010) resulted in several agreements, one of which focused on adaptation; the others focused on mitigation and financial, technology and capacity building. The Cancun Agreements affirmed that adaptation should be given the same priority as mitigation and the Cancun Adaptation Framework was established 'with the objective of enhancing action on adaptation' (point 13) ("Cancun Agreement to the United Nations Framework Convention on Climate Change," 2010). The Cancun Agreements also established an Adaptation Committee (AC) as an advisory body to the CoP, partly tasked with developing ways to assess adaptation (Adaptation Committee, 2016). The Agreements also established a process to formulate and implement NAPs, with guidelines that include 'reporting, monitoring and review'. There was continued focus on project-level assessment of adaptation actions, but also

[1] The differences between National Adaptation Programmes of Action (NAPAs) and National Adaptation Plans (NAPs) and National Adaptation Strategies (NASs) is discussed in Section 2.2.

[2] The equity issue, especially, suggests that wealthier countries should support all developing countries, as they have not benefited as much from the economic growth driven by burning fossil fuels and land use changes that have caused climate change. However, there are other considerations – a general international focus on development and the formation of negotiating blocs to push for further support for developing countries.

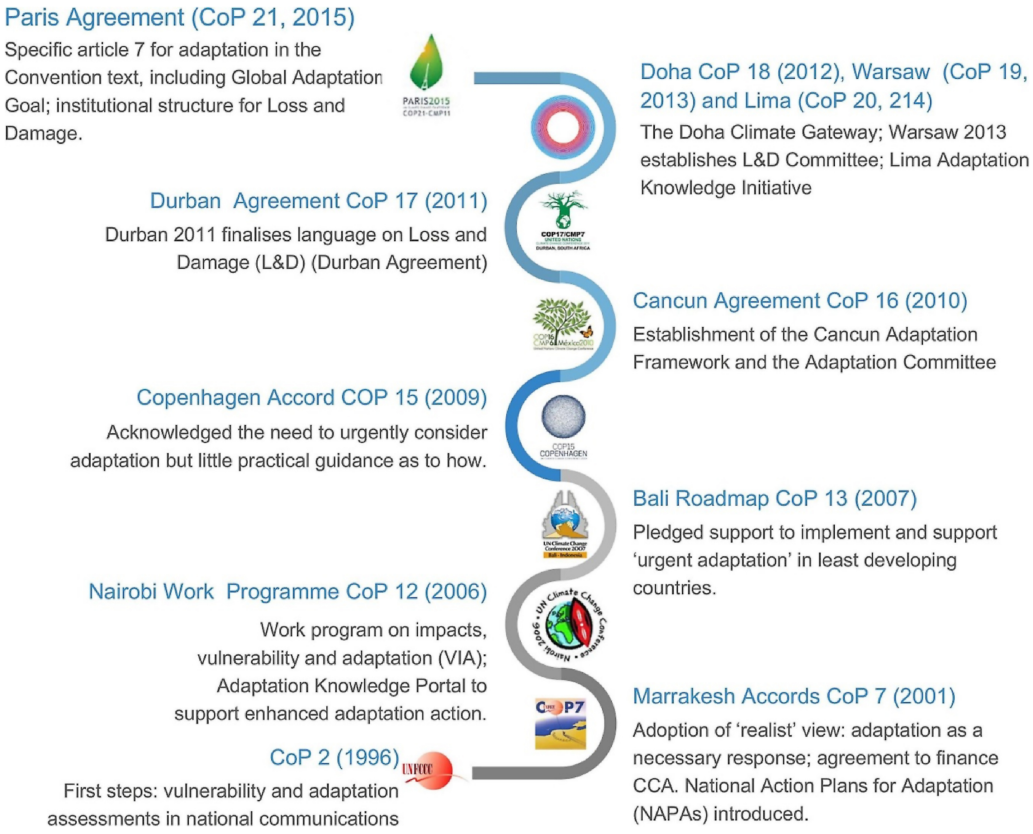
Paris Agreement (CoP 21, 2015)
Specific article 7 for adaptation in the Convention text, including Global Adaptation Goal; institutional structure for Loss and Damage.
Doha CoP 18 (2012), Warsaw (CoP 19, 2013) and Lima (CoP 20, 214)
The Doha Climate Gateway; Warsaw 2013 establishes L&D Committee; Lima Adaptation Knowledge Initiative
Durban Agreement CoP 17 (2011)
Durban 2011 finalises language on Loss and Damage (L&D) (Durban Agreement)
Cancun Agreement CoP 16 (2010)
Establishment of the Cancun Adaptation Framework and the Adaptation Committee
Copenhagen Accord COP 15 (2009)
Acknowledged the need to urgently consider adaptation but little practical guidance as to how.
Bali Roadmap CoP 13 (2007)
Pledged support to implement and support 'urgent adaptation' in least developing countries.
Nairobi Work Programme CoP 12 (2006)
Work program on impacts, vulnerability and adaptation (VIA); Adaptation Knowledge Portal to support enhanced adaptation action.
Marrakesh Accords CoP 7 (2001)
Adoption of 'realist' view: adaptation as a necessary response; agreement to finance CCA. National Action Plans for Adaptation (NAPAs) introduced.
CoP 2 (1996)
First steps: vulnerability and adaptation assessments in national communications

Fig. 1. Key adaptation decisions and initiatives emerging from UNFCCC CoP process.

greater guidance from the LDC Expert Group on creating NAPs, which encouraged some national level tracking of adaptation (LDC Expert Group, 2012). Note that some developed countries have developed their own NAPs separate from the UNFCCC-derived process.

Adaptation was a theme in the meetings in CoPs 17–20 in Durban, Doha, Warsaw and Lima, but the major outcomes from these meetings were largely focused on extending the Kyoto Protocol and advancing negotiations on a post-2020 agreement, with limited success. CoP 18 at Durban in 2012 did formalise language on 'Loss and Damage' ("Durban Agreement to the United Nations Framework Convention on Climate Change," 2011), which has implications for adaptation, among other things. Applying assessment of loss and damage implies a limit to adaptation, as well as the ability to specify the contribution of anthropogenic forced climate change to natural disasters (Huggel et al., 2013; Huq et al., 2013). Nonetheless, the inclusion of a reference to loss and damage in climate change negotiations remains controversial, with concerns from developed countries that they will be held liable for disasters.[3]

Following Copenhagen, CoP 21 in Paris became the focal point for bringing the negotiations on a post-2020 agreement to a successful conclusion based on, among things, the principle that negotiated outcomes should be 'applicable to all'. A novel outcome of the Agreement was to establish the global goal on adaptation of '…enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal…'. (Article 7, point 1). Article 7 further recognises that adaptation is a global task faced by all and that the Agreement aims to '…build a collective understanding of adaptation through metrics and tools that capture each country's efforts' (Magnan, 2016). These outcomes signalled a more ambitious, universal and collaborative attitude towards adaptation.

The Paris Agreement strengthened the focus on reporting and assessing adaptation efforts and laid down a challenge for tracking of collective adaptation progress at a global scale (Magnan, 2016). The Adaptation Committee has begun to provide guidance on tracking adaptation (Adaptation Committee, 2016). The 2018 CoP23 in Bonn focused on developing mechanisms to monitor, assess and report the outcomes agreed to in Paris, which is the ongoing focus on the upcoming CoPs. Reporting adaptation as part of this remains an unresolved problem.

The ongoing UNFCCC negotiations, now directed at implementation of the Paris Agreement, has bought with it changing areas of focus in monitoring and tracking adaptation, with the focus shifting from identifying impacts and assessing vulnerability, through project-level and some efforts at national level adaptation tracking through planning, to the current challenge of international level adaptation tracking. International efforts are now recognising these linkages and giving adaptation prominence as a negotiation issue (Helgeson and Ellis, 2015; Magnan and Ribera, 2016). Adaptation is now commonly part of Nationally Determined Contributions (NDCs) and National Communications (NCs) with 137 Parties including an adaptation component in their INDCs (UNFCCC, 2016). At the same time, increasing focus on integrating climate change responses with the Sustainable Development Goals (SDGs) (Ari, 2017; Iyer et al., 2018) is likely to further bring adaptation to the fore, as adaptation actions are often strongly linked to issues of development, disaster management, poverty reduction and other SDG goals. Tracking adaptation at an international scale and comparing efforts and successes of countries with very different

[3] Note that although Article 8 of the Paris Agreement commits Parties to continuing the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts Paris, in Decision 52 the parties also agreed that this does not involve or provide a basis for any liability or compensation. These counter-balancing decisions highlight the concern largely of developed countries who have been responsible for the majority of historic emissions.

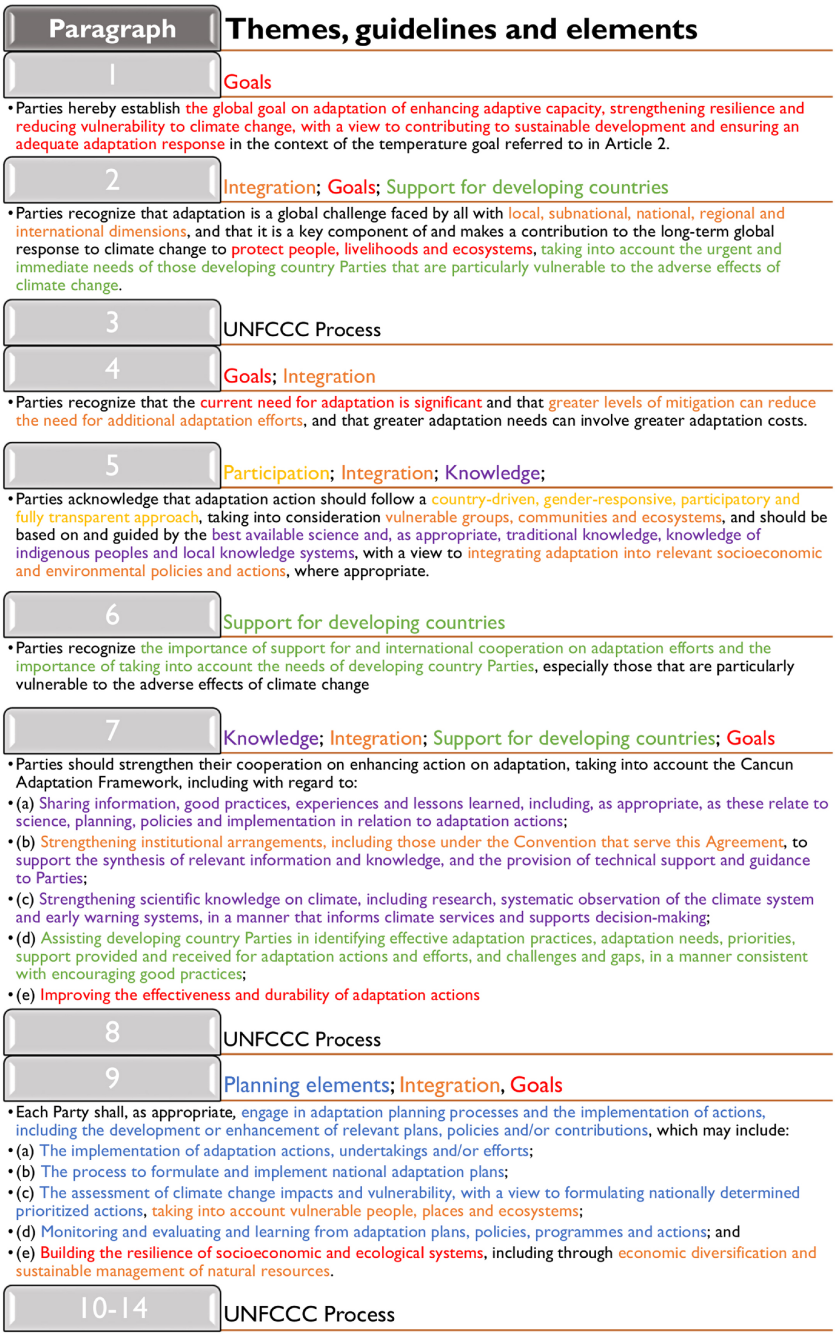
Paragraph
Themes, guidelines and elements
1
Goals
• Parties hereby establish the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2.
2
Integration; Goals; Support for developing countries
• Parties recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions, and that it is a key component of and makes a contribution to the long-term global response to climate change to protect people, livelihoods and ecosystems, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change.
3
UNFCCC Process
4
Goals; Integration
• Parties recognize that the current need for adaptation is significant and that greater levels of mitigation can reduce the need for additional adaptation efforts, and that greater adaptation needs can involve greater adaptation costs.
5
Participation; Integration; Knowledge;
• Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate.
6
Support for developing countries
• Parties recognize the importance of support for and international cooperation on adaptation efforts and the importance of taking into account the needs of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change
7
Knowledge; Integration; Support for developing countries; Goals
• Parties should strengthen their cooperation on enhancing action on adaptation, taking into account the Cancun Adaptation Framework, including with regard to:
• (a) Sharing information, good practices, experiences and lessons learned, including, as appropriate, as these relate to science, planning, policies and implementation in relation to adaptation actions;
• (b) Strengthening institutional arrangements, including those under the Convention that serve this Agreement, to support the synthesis of relevant information and knowledge, and the provision of technical support and guidance to Parties;
• (c) Strengthening scientific knowledge on climate, including research, systematic observation of the climate system and early warning systems, in a manner that informs climate services and supports decision-making;
• (d) Assisting developing country Parties in identifying effective adaptation practices, adaptation needs, priorities, support provided and received for adaptation actions and efforts, and challenges and gaps, in a manner consistent with encouraging good practices;
• (e) Improving the effectiveness and durability of adaptation actions
8
UNFCCC Process
9
Planning elements; Integration, Goals
• Each Party shall, as appropriate, engage in adaptation planning processes and the implementation of actions, including the development or enhancement of relevant plans, policies and/or contributions, which may include:
• (a) The implementation of adaptation actions, undertakings and/or efforts;
• (b) The process to formulate and implement national adaptation plans;
• (c) The assessment of climate change impacts and vulnerability, with a view to formulating nationally determined prioritized actions, taking into account vulnerable people, places and ecosystems;
• (d) Monitoring and evaluating and learning from adaptation plans, policies, programmes and actions; and
• (e) Building the resilience of socioeconomic and ecological systems, including through economic diversification and sustainable management of natural resources.
10-14
UNFCCC Process

Fig. 2. Themes, guidance and elements relevant to adaptation planning in Article 7 of the Paris Agreement. The paragraphs of Article 7 are reproduced with text relevant to each theme, guidance or element highlighted in colour: goals (red), integration (orange), participation (yellow), knowledge (purple), support for developing countries (green) and planning elements (blue).

contexts remains difficult. Adaptation is often seen as a domestic issue, although in practice it takes place in a multi-level governance and multi-sectoral context where responses undertaken in each level and sector is impacted by and impacts the other (Nalau et al., 2015).

. In addition, adaptation invokes consideration of long-term vulnerability, resilience and adaptive capacity – concepts that are, in themselves, complex and not necessarily amenable to being adequately accounted for by simple indicators (Christiansen et al., 2018; Magnan, 2016). Quantitative or definite goals for adaptation, similar to avoiding 1.5 °C or 2 °C of global warming, have to date not been developed.

As for mitigation, adaptation is a series of ongoing efforts that will need to be reassessed and revised. Assessing these efforts, will have to be, at least in part, about measuring and evaluating related processes, including adaptation planning (Craft and Fisher, 2016).

2.2. Adaptation planning

Adaptation planning is a key component of adaptation processes (Biesbroek et al., 2010; Füssel, 2007; Mullan et al., 2013; Preston et al., 2011; UNFCCC Secretariat, 2016). Effective planning can allow adaptation to become part of long-term decision-making and embed climate change considerations into everyday policy and planning considerations. Planning can operate at timescales relevant to climate change (30–50 years) and provide a focus on addressing responses to future impacts. As noted above, NAPA and NAP processes have been part of the UNFCCC system for over a decade (UNFCCC, 2014b, 2014c;

UNFCCC Secretariat, 2016), and there has been substantial development of adaptation plans and strategies across Europe and the OECD (Biesbroek et al., 2010; Preston et al., 2011).

The Paris Agreement includes a call for NAPs to be submitted to the UNFCCC Secretariat. While the focus on support for LDCs remains, the Agreement encourages the expansion of national adaptation planning to all parties (Adaptation Committee, 2016). Importantly, the CoP 21 decisions regarding implementation of the Agreement requested that the state of adaptation efforts, support, experiences and priorities be included into the global stocktake called for in Article 14 of the Agreement (Decision 100, (a), (ii), page 14). Starting in 2020, all national governments, including OECD countries, are required by the UNFCCC to develop national adaptation plans.

NAPAs and NAPs have evolved throughout the UNFCCC negotiations. The need for and aims of the NAPAs were outlined at CoP 7 in Marrakesh, and the agreement included guidelines for NAPAs, such as the need for it to be country-driven and focus on urgent actions, the need for a participatory, gender equal, multidisciplinary approach that was in line with other international agreements, and also a suggested structure for the plans ("Marrakesh Agreement to the United Nations Framework Convention on Climate Change," 2001). The Marrakesh Accords also set up a Least Developed Country Expert Group (LEG) to provide guidance and advice on the preparation and implementation strategy for NAPAs. As a result, they all take a similar approach, which includes participatory consultations and detailed analyses of impacts of climate change, vulnerability and prioritisation of action. A process for developing NAPs was established somewhat later under the Cancun Adaptation Framework (CAF) agreed to at CoP 16. The focus of NAPs is identifying medium- and long-term adaptation needs, as wells as strategies and programmes to address those needs. Technical guidelines for the NAP process were prepared by the LEG and consisted of four elements: (1) Lay the Groundwork and Assess Gaps; (2) Prepatory Elements; (3) Implementation Strategies; and (4) Reporting Monitoring and Review. Each element contains steps that should be undertaken as part of the NAP process. Again, this has resulted in a similar approach and commonalities between the NAPs.

Many developed countries have also produced national adaptation plans or strategies (Biesbroek et al., 2010; Mullan et al., 2013; Preston et al., 2011). These are often undertaken independently of the UNFCCC processes and do not refer directly to their guidelines. In some cases, the adaptation strategy has led to further national policies such as national plans that lay out, for example, projects and actions.

NAPAs and NAPs established through the UNFCCC have been developed through participatory processes and are designed to address national vulnerabilities, needs and priorities in a context-specific manner. NAPs or National Adaptation Strategies (NASs) developed outside of the UNFCCC serve much the same purpose but are often bureaucratic, government exercises in planning. Although technically a strategy can be different to a plan, being more high level and less action-oriented, the difference between strategies and plans are in practice often limited – most NAPs are strategic plans. For the analysis here, the intentions, goals and themes within the plan or strategy are most relevant and hence they are treated together.

Article 7 of the Paris Agreement is in many ways a distillation of the knowledge, guidelines and lessons from the NAPA/NAP process. Consideration of Article 7 and its implications for adaptation planning reveals several key themes, guidelines and elements relevant to adaptation planning that new or updated plans or strategies should reflect (Fig. 2). These themes guidelines and elements are generic due to the nature of the Agreement and it being fundamentally a process of diplomatic negotiations between state parties. However, the plans and strategies still do provide insights into international thinking and priorities for adaptation.

Here, we suggest that the identified themes, guidelines and elements provide the basis for criteria to assess the NAPs. Note that this analysis is not designed to evaluate the effectiveness of adaptation actions. Such an analysis requires detailed on-the-ground research over long time-periods in relation to the adaptation interventions that have been implemented in response to specified climate-related risks. Instead, the analysis here aimed to provide insight into the extent to which existing plans reflect the requirements of the Paris Agreement, in turn highlighting what these Paris Agreement based criteria for a NAP might mean for national adaptation planning that aligns with international considerations.

Table 1
Breakdown of adaptation plans analysed in this study.

Type of Adaptation Plan	Number of Countries
NAPA	38
NAP (developing countries)	6
NAS or NAP (developed countries)	10
Total	54

3. Methods

The analysis involved an assessment of all National Adaptation Plans/Strategies available in English based on the criteria identified from themes, guidance and elements identified in the Paris Agreement.

NAPAs, NAPs and NASs were sourced from those available from the UNFCCC and those available from Climate-Adapt.[4] In addition, a Google search was conducted for national adaptation plans. Only plans in English were analysed at this stage. In total, 54 plans were analysed: 38 NAPAs, 6 NAPs from developing countries (submitted to UNFCCC) and 10 NAPs/NASs from developing countries (Table 1). This is not exhaustive as new plans are being developed consistently and some plans were only available in languages other than English.

Although NAPs and NAPAs and NASs can have different specific aims, they all share the purpose of creating adaptation planning, and hence were all assessed here. Where a country had produced both a NAPA and an NAP, e.g. for Burkina Faso and Sudan, only the NAP was included on the assumption that this superseded the NAPA. In the case of developed country strategies and plans, often they have led to other national policy and programmatic documents that lay out projects and actions or perform assessment. For example, Germany has produced a German Strategy for Adaptation to Climate Change and an Actions Plan; Denmark has a Strategy for Adaptation to a Changing Climate, an Adaptation Plan and an Impact Assessment. Where available in English, these documents were included in the analysis where criteria dictated.

The criteria were developed from the Paris Agreement following the approach of Preston et al. (2011). Using expert analysis of the text of Article 7, 24 criteria were identified (Table 2) based on the identification of different themes, guidelines and elements discussed in the Introduction (Fig. 2). The authors developed a criterion based on the different concepts related to adaptation planning mentioned in Article 7, using expert analysis and knowledge of climate change adaptation to separate and collate the different concepts.

The scoring system was based on Preston et al. (2011) (Table 3) and used to develop specific qualitative scoring for each criteria (see Table S1 for more detail) based on expert knowledge. The range and nature of the criteria are such that interpretation of these conditions is necessary. A complete description of the specific scoring basis for each criterion is available in the Supplementary Information.

Each plan was rated according to the criteria outlined in Table 2 based on the expert evaluation of the authors. The plans were critically read to identify evidence for the concepts or processes within each criteria. The expert evaluation looked in the text for key terms in relation to each criterion, such as 'adaptive capacity, resilience and

[4] https://climate-adapt.eea.europa.eu/

Table 2
Criteria developed from Article 7 of the Paris Agreement, colour coded by theme, guidelines and elements (as discussed in the introduction): goals (red); integration (orange); knowledge (purple); supporting for developing countries (green); and planning elements (blue).

Criteria		Paragraph of Article 7
1	Does the NAP approach adaptation through enhancing adaptive capacity, strengthening resilience, reducing vulnerability?	1
2	Does the NAP give consideration to different scales?	2
3	Does the NAP consider protecting people, livelihoods and ecosystems (and give these equal weighting)?	2
4	Does the NAP identify current and immediate need for adaptation?	2, 4
5	Does the NAP consider or make reference to mitigation actions?	4
6	Does the NAP consider needs of the country?	5
7	Does the NAP consider gender as an issue in adaptation?	5
8	Is there significant participation involved in creating and implementing the NAP?	5
9	Are vulnerable groups and communities identified and actions for them included in the NAP?	5
10	Are vulnerable ecosystems identified and actions for them included in the NAP?	5
11	Is the NAP based on the best available science?	5
12	Are traditional knowledge, knowledge of indigenous peoples and local knowledge systems included in the NAP?	5
13	Does the NAP include integration of adaptation into relevant socioeconomic and environmental policies and actions?	5
14	Does the NAP include support for developing countries? (not applicable to developing countries)	6
15	Does the NAP include international cooperation?	7
16	Does the NAP report existing implementation of actions?	9
17	Is the process for formulating and implementing the NAP clear?	9
18	Does the NAP include assessment of impacts and vulnerability?	9
19	Does the NAP include prioritised actions?	9
20	Does the NAP consider monitoring and evaluation?	9
21	Does the NAP include actions that will build the resilience of socioeconomic systems?	9
22	Does the NAP include actions that will build the resilience of ecological systems?	9
23	Does the NAP include economic diversification?	9
24	Does the NAP include sustainable management of natural resources?	9

Table 3
Basis of scoring of criteria in plans, from Preston et al. (2011).

Score	Necessary Conditions
0	No evidence of consideration for a particular criterion was apparent within the published plan. This suggests a particular concept or planning process was neglected
1	Evidence exists of consideration of a particular criterion during the development of the adaptation plan. This suggests the concept or process in question was recognised or acknowledged as being of some importance. However, the concept or process remained underdeveloped, suggesting additional consideration may be required for robust planning.
2	Evidence exists of consideration of a particular criterion during the development of the adaptation plan and significant effort was invested as part of the planning process (or prior to the planning process) to establish a particular criterion or complete a particular process.

vulnerability' for criterion 1, to answer the question posed for each criteria in Table S2 in the supplementary data. If the concepts or processes relevant for each criteria were found, we then considered how deeply the concept or process was reflected within the plan with a score of '2' if well detailed or '1' if only mentioned or just acknowledged. Where the ideas relevant to a criteria were the basis for actions, projects or processes within the plan then the plan was given a score of 2. For example, many plans simply mentioned gender equality as important (and scored 1) but some plans described processes that address this theme with specific actions such as separate workshops for women in the plan consultation stage or included specific objectives or actions to address gender inequality involving projects aimed at supporting women; these would score 2. For criteria that included more than one concept or process, such as 'Criteria 3: protecting people, livelihoods and ecosystems', we made a judgement on how the plan balanced these different concepts. For example, most NAPAs emphasised people and livelihoods over the environment, with projects having a social development component but fewer having an environmental focus. To receive the higher score, the plan had to have some balance between the different concepts so that a plan with a primary focus on development would only score 1. Similarly, assessing whether the plan included adaptive capacity, resilience and vulnerability, each term was searched for in the document. If each term was mentioned a score of 2 was given, if only one or two of the three terms were mentioned, then a score of 1 was given.

The results were stored in an Excel spreadsheet (see dataset linked to paper), with evidence provided for each score (such as quotations from plans and description of elements included/excluded (details provided in the supplementary data). Given that the scores were partly relative and subjective, the authors independently assessed and the crosschecked the scoring to help ensure a level of rigour and consistency in how the scoring system was applied. The analysis mainly considers the inclusion of concepts within the plan, rather than detailed evaluation of them. For example, criteria around Monitoring and Evaluation (M&E) were based on the description of some sort of M&E process within the plans, rather than an evaluation of whether the M&E in the plans was suitable or likely to be effective, which was not impossible within the scope of a desktop review.

Note that the criterion 14 'Does the NAP include support for developing countries?' was not applicable to developing countries and LDCs. Consequently, this criterion was not included in the final aggregate score of the plans to avoid bias. The maximum score possible for all countries therefore was 46. However, the criterion was still assessed, and is included in tables in italics, because it was considered an important element of the Paris Agreement, reflecting the emphasis placed on supporting developing countries as part of a just and equitable response to climate change. This criterion therefore provides insight into how developed countries prioritise support for other nations (see Results).

The adaptation planning scores were then plotted against available global data sets that provided national level indicators of: (1) vulnerability measured by NDGAIN (Notre Dame Global Adaptation Initiative, 2018), (2) exposure measured by NDGAIN (Notre Dame Global Adaptation Initiative, 2018), (3) GDP per capita (World Bank, 2018), and (4) CO_2 emissions per capita data (World Bank, 2018) at a national level. Values for the scores and other climate-related and socio-

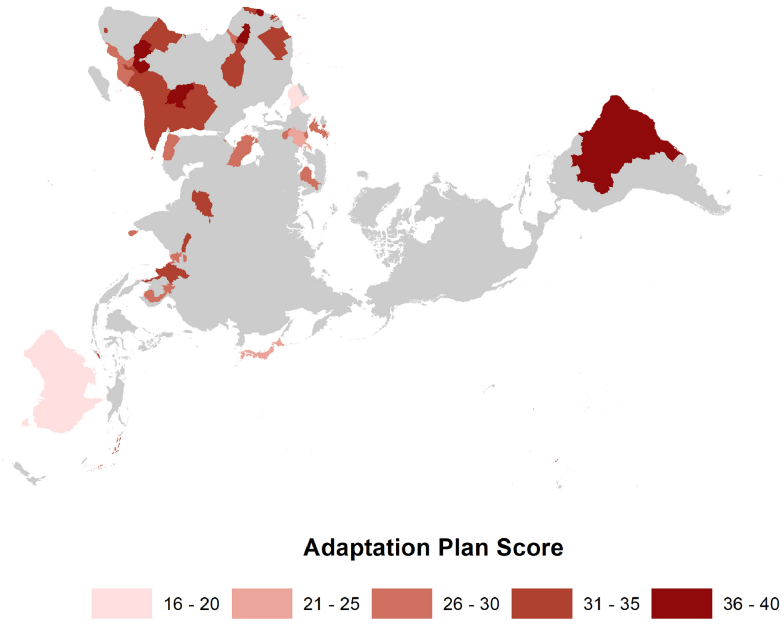

Fig. 3. Scores for adaptation plans based on criteria developed from the Paris Agreement. Countries with lower adaptation planning scores reflect weaker alignment with the criteria derived from Article 7 of the Paris Agreement.

economic factors for each nation were graphed using scatter plots for their relationships for visualisation purposes. The purpose of this exploratory analysis was to investigate whether there was any indication that the standard of a nation's adaptation plan may be related to documented climate-related pressures or socio-economic conditions.

4. Results

The scores from assessing the 54 adaptation plans ranged from 18 to 38 out of possible maximum of 46 (Fig. 3, Table S2). Plans that scored less than 25 reflect overall weaker alignment of Paris criteria whereas plans that scored over 35 show high correlation with Article 7. The majority of plans scored close to the average score of 31 (32/54 scoring between 29 and 33).

In order to investigate whether the adaptation plan scores are related to documented climate-related pressures or socio-economic conditions, the total plan score (out of 46) was plotted against existing measures of vulnerability, GDP, exposure and carbon emissions. The plot of adaptation plan scores and vulnerability index values (Fig. 4A), suggests that countries that are more vulnerable generally have plans more closely aligned to the Paris Agreement. Note, however, that the way the vulnerability index is calculated means it is strongly linked to development and GDP and other social pressures; hence the very high vulnerability for Somalia and Niger. This link to GDP is highlighted when plotting adaptation plan scores to GDP per capita, which shows the same clustering of richer, developed countries with lower adaptation plan scores and poorer developing countries with generally higher scores (Fig. 4B). This strong dependence of vulnerability on GDP hides some important adaptation issues; although wealthier countries might be seen as less vulnerable because their adaptive capacity is estimated greater, they still need good planning to adapt effectively and remain resilient over time.

Comparing the adaptation planning score with exposure instead of vulnerability helped to tease out some of the effects of wealth and development (Fig. 5). Although the trend is similar, there are outliers such as Japan and Australia that face significant exposure but whose plans are less aligned to the Paris Agreement. Spain also scores lower but has less exposure. Overall, our analysis emphaiszes that there is less of a difference between developed and developing countries than what is inferred from considering just the aggregate vulnerability index. Similarly, the more exposed LDCs have clearly benefited from plans developed through the NAPA process, although some of the most highly exposed countries only score around average.

Comparing the adaptation plan score to emitted tonnes of CO_2 per capita is also informative, especially considering the linkages between mitigation and adaptation (Fig. 6). Those countries with greater per capita emissions tend to have lower adaptation plan scores, while those with higher plan scores have similar (and low) per capita emissions. Hence, future NDCs of these countries may require greater commitments on both mitigation and adaptation. At the same time, the data reflect the controversial discussions over responsibility for funding adaptation costs in developing countries as well as the loss and damage issue (Lees, 2017).

Although the overall score reveals some general trends in terms of alignment with the Paris Agreement, more details on how particular plans align are revealed by the scores for each criterion (Tables 4 and 5). Firstly, there are some common features between the plans: 'vulnerability and impact assessments' (criteria 18 – 46 out of 54 adaptation plans scoring 2); 'the use of the best available science' (criteria 11 – 54/54 scoring 2); 'prioritisation of actions' (criteria 19 – 47/54 scoring 2); 'integration with existing policies' (criteria 13 – 47/54 scoring 2); 'including actions that will build the resilience of socioeconomic systems' (criteria 21 – 44/54 scoring 2); and 'a country-specific focus' (criteria 6 – 54/54 scoring 2). One criterion where all plans score highly is 'meeting the needs of the country' (criteria 6; 54/54 score 2). Also, 48/54 scored 2 on 'integration of adaptation into relevant socio-economic and environmental policies'. This may suggest that these are areas of strong international agreement around adaptation planning; however, it is also likely that the Paris Agreement has been strongly influenced by the UNFCCC NAPA and NAP processes, where these concepts are emphasised.

Despite the relative consistency, there are also some key differences between plans. Aspects that are usually present only in higher scoring plans are: 'consideration of previous/current adaptation actions' (27/54 plans scoring 2); 'use of local/traditional/Indigenous knowledge' (6/54, plans scoring 2, sometimes out of necessity when science is limited), and 'considering mitigation actions' (4/54 scoring 2). Finally, plans with higher scores tended to explicitly include vulnerability, adaptive capacity and resilience within the plan. Many plans, especially earlier NAPAs, tended to focus on vulnerability and adaptive capacity. In many

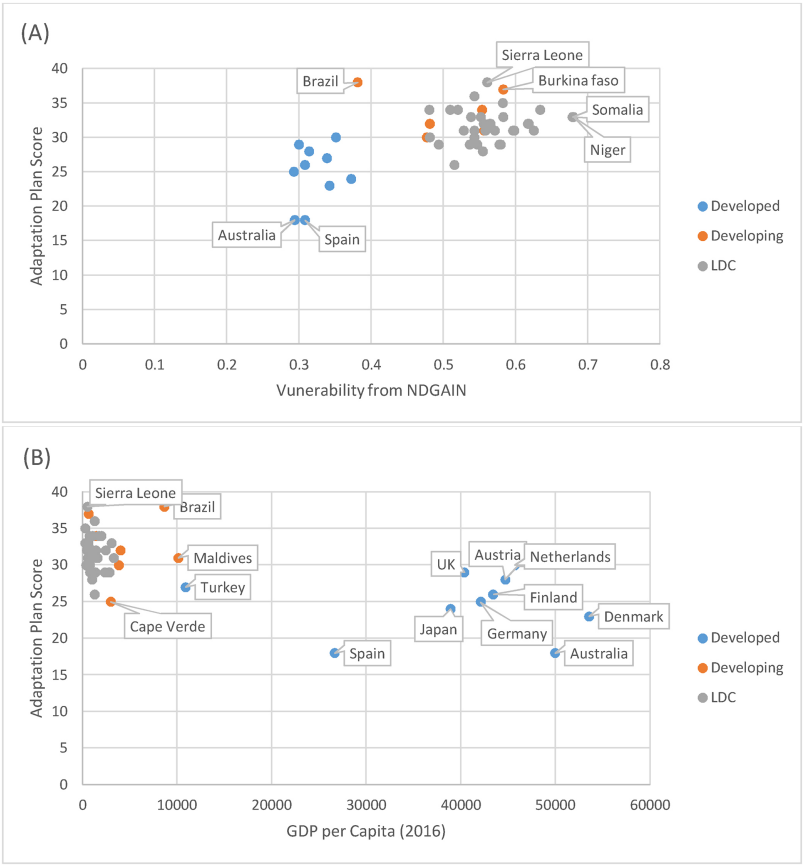

Fig. 4. (A) Adaptation plan scores vs. vulnerability (2016) score from NDGAIN. (B) Adaptation Plan score vs. GDP per capita (2016, from World Bank).

of these cases, the plans would also lead to increase resilience as well, but addressing resilience is not explicitly part of the adaptation plan. Where resilience was included, it was often in the context of disaster management and 'bouncing back' from impacts.

Plans that scored higher tended to have a strong participatory approach (Table 4). For example, Brazil had a focus on knowledge and identifying vulnerable groups (scoring highly on criteria 8, 9, 11, 12 and 18), which results in the highest overall score. Similarly, Burkina Faso has a strong focus on gender equality and vulnerability of women and participation (scoring high on criteria 7, 8 and 9), which boosts its overall score. Participation and gender were key elements of NAPAs with many developing countries score 2 for at least one of these criterion. In contrast, lower scoring plans, especially those from developed countries, have relatively little focus on gender (e.g. Spain and Australia), local and Indigenous knowledge (e.g. Spain) and participation (Turkey and UK).

Only seven of the 54 plans were assessed as giving a balanced account of adaptation with respect to protecting people with more nature-focused aims (scoring 2 on criteria 3). Similarly, plans that score more highly tend to gain in areas of 'sustainable resource management' (criteria 24) and actions that 'build the resilience of ecosystems' (criteria 22), as well as balancing livelihood and people protection with ecosystem protection (criteria 10). Very few plans score highly in these areas (criteria 10 – 4/54 score 2; criteria 22 – 11/54 score 2; criteria 24 – 13/54 score 2), although these tend to be the highest scoring plans. For example, Brazil's NAP includes consideration of ecosystem-based adaptation – 'Promote and integrate a crosscutting Ecosystems-based Adaptation (EbA) methodology for all sectors, for use of ecosystem

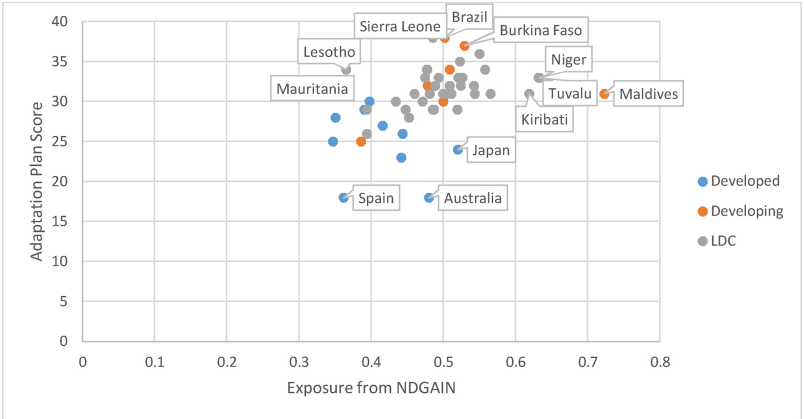

Fig. 5. Adaptation plan score vs. exposure (2016) from ND-GAIN.

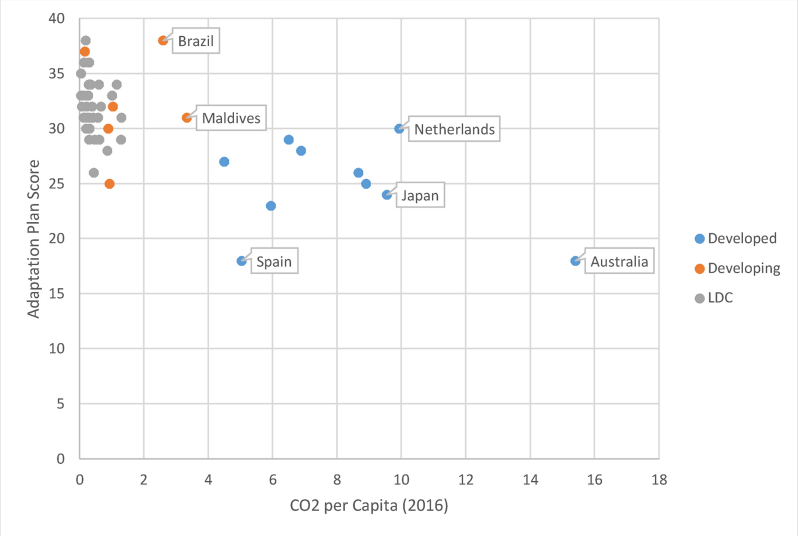

Fig. 6. Adaptation plan score vs. CO_2 per capita 2014 (from World Bank, 2018).

services as an alternative and/or complementary adaptation strategy' (Ministerio do Meio Ambiente (MMA), 2016, p. 19) – as well as several goals focused on the sustainable management of natural resources. Similarly, Burkina Faso includes sustainable natural resource management as a 'sector' and provides specific objectives and indicators, and Sierra Leone includes projects specifically aimed at both ecological resilience and sustainable natural resource management. These are the exceptions though as few plans score well on these more environmentally-focused criteria.

5. Discussion

Although there are trends apparent between overall the adaptation plan score and selected published vulnerability and related indicators, our analysis does not support a clean division between developed and developing countries. The variety and range of criteria mean that a focus on overall scores hides important insights. Combining the general trends with more detailed analysis of the individual criteria scores, collectively and by country, is more revealing.

5.1. Consistency of approach: more integrated but not yet holistic

Overall, the results suggest that NAPAs and NAPs prepared with support from the UNFCCC (those covering LDCs and developing countries) tend to receive higher adaptation plan scores. We suggest this reflects two factors. First, the text within Article 7 of the Paris agreement has been strongly influenced by the development and experiences of both the NAPA and NAP process within the UNFCCC. Many of the

Table 4
Scores recorded for each criterion developed from Article 7 of the Paris Agreement, see Table 2 for details of criteria. The right hand side reports how many countries scored 1 or 2 in their plans for all countries and a breakdown by developed and developing/LDC countries.

Criteria		Number of Countries scoring 1 or 2					
		All		Developed		Developing	
		1	2	1	2	1	2
1	Adaptive capacity, resilience and vulnerability	31	23	7	3	24	20
2	Different scales	40	7	6	3	34	4
3	Protecting people, livelihoods and ecosystems	47	7	8	2	39	5
4	Current and immediate need for adaptation	9	45	7	3	2	42
5	Inclusion of mitigation actions	23	3	7	2	16	1
6	Needs of the country	0	54	0	10	0	44
7	Gender	25	10	1	1	24	9
8	Participation	10	41	6	1	4	40
9	Vulnerable groups and communities	19	26	3	0	16	26
10	Vulnerable ecosystems	47	4	10	0	37	4
11	Best available science	0	54	0	10	0	44
12	Traditional indigenous and local knowledge	33	6	1	0	32	6
13	Integration into socioeconomic and environmental policies	5	48	2	7	3	41
14	*Support for developing countries (developed countries only)*	*4*	*2*	*4*	*2*	*N/A*	*N/A*
15	International cooperation	14	1	7	1	7	0
16	Existing implementation of actions	18	27	4	5	14	22
17	Process for formulating and implementing	3	50	3	7	0	43
18	Assessment of impacts and vulnerability	8	46	6	4	2	42
19	Prioritised actions	5	47	4	4	1	43
20	Monitoring and evaluation	14	34	4	3	10	31
21	Build resilience of socioeconomic systems	7	44	6	2	1	42
22	Build resilience of ecological systems	37	11	8	0	29	11
23	Economic diversification	23	0	2	0	21	0
24	Sustainable management of natural resources	36	13	6	2	30	11

Table 5
Individual criterion scores for each country. Criteria numbering is the same as Tables 2 and 4. Status is development status as per the UN: LDC = least developed country; devg = developing; devd = developed. Note criteria 14, 'Support for developing countries' was not included in total score.

Country	Type	Status	Year	Total Score	Criteria																							
					1	2	3	4	5	6	7	8	9	10	11	12	13	*14*	15	16	17	18	19	20	21	22	23	24
Afghanistan	NAPA	LDC	2009	31	1	0	1	2	0	2	1	2	2	1	2	1	2	*N/A*	1	1	2	2	2	2	2	1	0	1
Angola	NAPA	LDC	2011	31	1	2	1	2	1	2	1	2	1	1	2	1	1	*N/A*	1	0	2	2	2	0	2	2	1	1
Australia	NAS	Devd	2015	18	1	1	1	1	1	2	0	0	0	1	2	1	0	*1*	1	2	1	1	0	0	1	1	0	0
Austria	NAS	Devd	2012	28	2	1	1	1	2	2	1	2	1	1	2	0	1	*1*	1	2	2	1	2	1	1	1	0	0
Bangladesh	NAPA	LDC	2009	29	2	0	1	2	0	2	2	2	1	1	2	1	2	*N/A*	1	1	2	2	2	2	0	1	0	0
Bhutan	NAPA	LDC	2006	29	2	0	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	0	2	2	2	2	2	0	0	1
Brazil	NAP	Devg	2016	38	2	1	2	2	1	2	1	2	2	2	2	2	2	*N/A*	1	1	2	2	2	2	1	2	0	2
Burkina Faso	NAP	Devg	2015	37	2	1	1	2	1	2	2	2	2	1	2	1	2	*N/A*	1	2	2	2	2	1	2	1	1	2
Burundi	NAPA	LDC	2007	35	2	1	2	2	1	2	2	2	0	2	2	1	1	*N/A*	0	2	2	2	2	2	2	1	0	2
Cambodia	NAPA	LDC	2007	26	1	1	1	2	0	2	0	2	1	0	2	1	2	*N/A*	0	1	0	2	2	2	2	1	0	1
Cape Verde	NAPA	Devg	2007	25	1	0	1	1	0	2	0	2	1	0	2	1	2	*N/A*	0	1	2	2	2	1	2	0	1	1
Comoros	NAPA	LDC	2006	30	1	1	1	2	0	2	0	2	2	1	2	1	2	*N/A*	0	1	2	2	2	2	2	1	0	1
Denmark	NAS	Devd	2008	23	1	0	1	1	0	2	0	1	0	1	2	0	2	*1*	1	2	2	2	1	0	1	1	1	1
Eritrea	NAPA	LDC	2007	31	1	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	1	2	2	2	2	2	1	0	1
Ethiopia	NAPA	LDC	2008	31	1	0	1	2	2	2	0	2	1	1	2	0	2	*N/A*	0	2	2	1	2	2	2	1	1	2
Finland	NAS	Devd	2005	26	1	1	1	2	1	2	0	1	0	1	2	0	2	*1*	1	1	2	1	2	2	1	1	0	1
Gambia	NAPA	LDC	2008	33	2	2	1	2	0	2	1	2	0	1	2	2	2	*N/A*	0	2	2	2	2	2	2	1	0	1
Germany	NAS	Devd	2008	25	1	2	1	1	1	2	0	1	0	1	2	0	2	*2*	2	2	2	2	0	2	0	0	0	1
Guinea-Bissau	NAPA	LDC	2008	31	1	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	2	2	2	2	1	2	1	0	1
Japan	NAP	Devd	2015	24	1	1	1	2	1	2	0	1	0	1	2	0	2	*2*	1	2	1	1	1	1	1	1	0	1
Kenya	NAP	Devg	2017	34	2	2	1	2	1	2	2	1	2	0	2	1	2	*N/A*	0	2	2	2	1	2	2	1	1	1
Kiribati	NAPA	LDC	2007	31	1	1	1	2	0	2	1	2	1	1	2	1	2	*N/A*	1	2	2	2	2	1	2	1	0	1
Laos	NAPA	LDC	2009	29	1	1	1	2	0	2	0	1	1	1	2	0	2	*N/A*	0	2	2	2	2	2	2	1	1	1
Lesotho	NAPA	LDC	2007	34	2	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	2	2	2	2	2	2	1	1	1
Liberia	NAPA	LDC	2007	32	2	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	1	2	2	2	2	2	0	1	1
Malawi	NAPA	LDC	2006	33	2	1	1	2	0	2	2	2	2	1	2	1	2	*N/A*	0	0	2	2	2	2	2	2	0	1
Maldives	NAPA	Devg	2008	31	2	1	1	2	0	2	1	2	2	1	2	0	2	*N/A*	0	1	2	2	2	2	2	1	0	1
Mauritania	NAPA	LDC	2004	32	1	1	1	2	0	2	1	2	1	1	2	1	2	*N/A*	0	2	2	2	2	2	2	1	0	2
Mozambique	NAPA	LDC	2008	30	1	1	1	2	1	2	0	2	2	1	2	1	2	*N/A*	0	0	2	2	2	1	2	1	1	1
Myanmar	NAPA	LDC	2013	31	2	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	1	2	2	2	0	2	2	0	1
Nepal	NAPA	LDC	2010	34	1	1	1	2	1	2	0	2	2	1	2	1	2	*N/A*	0	2	2	2	2	2	2	2	0	2
Netherlands	NAS	Devd	2016	30	1	2	2	2	1	2	0	1	0	1	2	0	2	*0*	1	1	2	2	2	1	2	1	0	2
Niger	NAPA	LDC	2006	33	1	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	2	2	2	2	2	2	1	1	1
Rwanda	NAPA	LDC	2007	32	1	1	1	2	0	2	0	2	2	1	2	1	2	*N/A*	0	2	2	2	2	2	2	1	1	1
Samoa	NAPA	Devg	2005	32	2	0	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	0	2	2	2	2	2	2	1	1
Sao Tome and Principe	NAPA	LDC	2007	34	1	1	1	2	1	2	2	2	2	1	2	1	2	*N/A*	0	0	2	2	2	2	2	2	1	1
Sierra Leone	NAPA	LDC	2008	38	1	1	2	2	1	2	2	2	2	2	2	1	2	*N/A*	0	2	2	2	2	2	2	2	0	2
Solomon Islands	NAPA	LDC	2008	34	2	1	1	2	1	2	1	2	2	1	2	1	2	*N/A*	0	1	2	2	2	2	2	1	0	2
Somalia	NAPA	LDC	2013	33	1	1	1	2	0	2	1	2	2	1	2	0	2	*N/A*	0	2	2	2	2	2	2	1	1	2
South Sudan	NAPA	LDC	2017	36	1	1	2	2	1	2	1	2	2	2	2	2	2	*N/A*	0	0	2	2	2	2	2	2	1	1
Spain	NAS	Devd	2006	18	1	1	1	1	1	2	0	1	0	1	2	0	1	*0*	0	0	2	1	2	0	0	0	0	1
Sri Lanka	NAP	Devg	2016	30	2	1	1	2	1	2	0	1	1	1	2	2	2	*N/A*	0	1	2	1	2	2	2	1	0	1
State of Palestine	NAP	Devg	2016	27	1	1	1	1	1	2	2	2	1	1	2	0	1	*N/A*	0	1	2	2	2	1	2	0	1	0
Sudan	NAP	LDC	2016	32	2	2	1	2	0	2	1	2	2	1	2	0	2	*N/A*	0	1	2	2	2	1	2	1	1	1
Tanzania	NAPA	LDC	2007	31	1	1	1	2	0	2	1	2	1	1	2	1	2	*N/A*	0	2	2	2	2	1	2	1	1	1
Timor-Leste	NAPA	LDC	2011	32	2	1	1	2	0	2	1	2	2	1	2	1	2	*N/A*	0	2	2	2	2	1	2	1	1	0
Turkey	NAS	Devd	2011	27	2	1	1	1	2	2	2	0	1	1	2	0	2	*0*	0	1	2	1	1	2	1	1	0	1
Tuvalu	NAPA	LDC	2007	33	1	1	1	2	0	2	1	2	1	1	2	2	2	*N/A*	0	2	2	2	2	2	2	2	0	1
Uganda	NAPA	LDC	2007	33	1	1	1	2	0	2	1	2	1	1	2	2	2	*N/A*	0	2	2	2	2	2	2	1	0	2
UK	NAS	Devd	2013	29	2	2	2	1	1	2	0	0	1	1	2	0	2	*0*	1	1	1	2	1	1	2	1	1	2
Vanuatu	NAPA	LDC	2007	29	2	1	1	2	1	2	0	1	1	1	2	1	2	*N/A*	0	2	2	2	2	0	2	1	0	1
Yemen	NAPA	LDC	2009	28	1	1	1	2	0	2	0	2	1	1	2	1	2	*N/A*	0	0	2	2	2	2	2	1	0	1
Zambia	NAPA	LDC	2007	36	2	1	2	2	1	2	1	2	1	1	2	1	2	*N/A*	0	2	2	2	2	2	2	2	1	1

requirements detailed in Article 7 reflect the guidelines outlined by the LEG (LDC Expert Group, 2012), in particular the inclusion of participation, gender, and local/traditional/Indigenous knowledge, where many plans from LDCs score well. The requirements about the urgent and immediate nature of adaptation also reflect the NAPA process (all NAPAs scored 2 in this area). Secondly, the fact that there are consistent scores for several criteria even across the developed country plans potentially reflects a broad agreement on at least some aspects of adaptation planning (Table 4, see also Table S3 for ranked criteria).

Most plans scored well in a shared set of indicators: 'assessments of vulnerability and impact'; 'the use of the best available science'; 'prioritisation of actions'; 'integration with existing policies'; 'building the resilience of socioeconomic systems'; and 'having a country-specific focus'. This suggests that these criteria represent elements that are widely accepted as important for national adaptation. The focus on integration is encouraging and suggests that the opportunities to mainstream adaptation are at least being recognised. This is perhaps related to the close relationship between adaptation and development and disaster management, all of which are high and immediate priorities across the countries. The need to address what are typically seen as more immediate risks provides an opportunity for policy-makers to mainstream at least some elements of adaptation planning. Identifying vulnerable ecosystems (criteria 10 – 47/54 scoring 1), and consideration of different scales (criteria 2 – 40/54 scoring 1) were also common across the plans, but were less well developed. This suggests that scale and ecosystem considerations are becoming more important, but are not yet fully incorporated into planning.

The human-centred nature of planning, traditionally focused on

economic development and managing population growth, means consideration of ecosystems is still a relatively new feature of adaptation planning. However, resource scarcity and greater understanding and awareness of human impacts on ecosystems, combined with the growing understanding of the benefits ecosystem services provide to people, mean that natural resource management is an increasing part of strategic planning at all levels. This brings with it new consideration of scales, reflected in moves towards more regional or catchment-scale planning, which is also encouraged by more holistic approaches, improved cross-sectoral collaborations and more polycentric governance that includes stakeholders at all levels (local, provincial, national and international) (Nalau et al., 2015; Robinson et al., 2011; Selman, 2006).

NAPs developed outside the UNFCCC process (e.g. European countries) tend to score lower on participation and inclusion of traditional/local/Indigenous knowledge. Developing and less developed countries often include significant stakeholder engagement in development and some go further. Sri Lanka includes a specific project to 'Study and Identify traditional methods of biodiversity management in agro ecosystems' (Ministry of Mahaweli Development and Environment, 2016, p. 79) and countries such as Tuvalu, Uganda and Gambia specifically document or set out to document stakeholder knowledge. In contrast, NAPs of developing countries were more expert-based and technocratic. These differences reflect the fact that the UNFCCC NAPA and NAP processes provide very clear guidelines that emphasise the importance of participation and local knowledge. It should be noted that participation is often part of developed countries NAPs or NASs – local-scale action is often the aim within them, but their formulation remains centralised and technocratic. However, participation within the planning process is widely recognised as key to effective planning, in particular for getting 'buy in' from stakeholders, which is more likely to result in action. This suggests that developed countries might have something to learn from the processes in developing countries if alignment of adaptation planning at the international level is to include greater participation.

5.2. The flexibility of adaptation: adaptation vs. development

The plans also demonstrate that adaptation as a concept is highly malleable. The plans exist in varying contexts, geographies, politics and economies, and yet adaptation planning sufficiently flexible as a concept to 'meet the needs' of all countries – as defined by the countries in their planning process. At the same time, adaptation planning can be used to harness resources for a wide variety of goals and projects. This is highlighted by the NAPAs where adaptation is often presented as activities contributing to development, especially agricultural development, water management and disaster relief.

This might suggest that any development measure that addresses poverty is a valid and sensible adaptation option. However, equity (Mearns and Norton, 2010), maladaptation (Barnett et al., 2015) and redistribution (Atteridge and Remling, 2017) must be considered. This adaptation versus development challenge is well recognised in the literature, and debate continues as to what should be considered adaptation and what is solely development (Adams and Falzon, 2017). This is not just an academic debate as the lack of clarity on the differences risks derailing or slowing funding available as parties fail to agree what can and cannot be included in adaptation funding. Adaptation planning will both guide, and be influenced by, funding. However, in those places looking to international funds for projects, adaptation planning will be in part determined by what the international community sees as adaptation, including what is defined as high adaptation priorities in the national plans.

One interesting aspect of the role of development in adaptation is the inclusion of help for developing countries in national planning. Adaptation planning at a national scale is focused on the needs of a country. However, Article 7 of the Paris Agreement includes an agreement to support the adaptation of developing countries. This raises the question of whether support for other countries should be included within national adaptation planning or remain separate from it, such as only being included in NDCs. Six out of ten developed countries included this support within their national plans in some form, although only Japan and Germany scored 2 on this. This suggests that, despite the national focus, some developed countries recognise the importance of supporting developing countries as part of their own national adaptation strategy. One possible explanation is that these countries recognise that adaptation, like mitigation, has transboundary implications. For example, impacts of climate change could create mass migration from countries unable to adapt. As building support for developing countries into the national plan strengthens commitments made under international agreements, it could also be argued that having support for other nations better reflects the 'spirit' of the Paris Agreement.

Overall, although this 'malleability' of adaptation provides the potential for adaptation to be co-opted to achieve goals that might not address vulnerability, resilience or adaptive capacity, it has the advantage of supporting the inclusion of adaptation into existing plans and policies, i.e., mainstreaming. This is reflected in the high number of NAPs and NAPAs scoring 2 on integration of adaptation into relevant socioeconomic and environmental policies. Although this does not automatically translate into effective mainstreaming, it does suggest that countries are considering mainstreaming adaptation.

5.3. Socio-economic vs. ecological framing

The strong link between adaptation and development also highlights the strong socio-economic framing of the plans. Adaptation plans are often focused principally on protecting people and livelihoods rather than ecosystems and natural resource management. While this focus is unsurprising, the Paris Agreement specifically identifies protecting biodiversity, ecosystem integrity and natural resource management as important aspects of climate change response, for adaptation as well as mitigation. This suggests that there is scope to better include an ecological framing into adaptation planning in line with the Paris Agreement commitments.

A greater ecological focus in national adaptation planning will inevitably raise concerns regarding what is conventionally seen as the inevitable trade-offs between environmental, economic or social outcomes. Developing countries, in particular, face difficult choices as following similar historical development paths to the more developed world may reduce their ecological resilience and the flows of ecosystem service benefits, which in turn support social adaptive capacity (Munang et al., 2013a). Adaptation planning can help bring a different focus to development pathways that promotes synergies rather than trade-offs between environmental, social and economic goals.

Including the ecological dimension can help resolve adaptation versus development tensions by encouraging greater attention on nature-based adaptation actions. Conventionally, development has focused primarily on socio-economic objectives, particularly poverty alleviation. A more comprehensive approach is warranted, however, when it is recognised that both development and adaptation have both social and ecological dimensions, pointing to the value of a socio-ecological systems framing (Berbés-Blázquez et al., 2017) as a core component of sustainability (Eriksen et al., 2011).

Considered together these trends reflect the benefits of more holistic approaches widely discussed in the literature: including resilience alongside vulnerability (Salinas Rodriguez et al., 2014; Vogel et al., 2011); incorporating a specific focus on ecosystems (Harvey et al., 2014; Munang et al., 2013b); and ensuring participation (Bauer et al., 2011; Hegger et al., 2012) and inclusion of a wide range of people and knowledge (Hegger et al., 2012; Leonard et al., 2013). Hence, the requirements of Article 7 in the Paris agreement have the potential to encourage a more integrated and comprehensive approach to adaptation planning. Although the first iteration of planning might focus on

immediate country needs and vulnerability of people, the next step can be to include ecological vulnerability and resilience and consider vulnerability, resilience and adaptive capacity together as complementary. Planning is, after all, a continuous process, not a once-off and static final outcome.

5.4. Limitations and further work

Only adaptation plans in English were considered in this analysis, due to a lack of resources for translation. Future work will add plans in other languages to the analysis. Preston et al. (2011) note some limitations of their method that are applicable here. In particular, the analysis only considers adaptation plans, which are high-level formal, strategic documents that can lack details of the implementation of specific actions. In addition, some adaptation actions are likely to be informal, implicit and not necessarily formally recognised as adaptation. These limitations are inherent to the desktop nature of the present assessment as well as to the reliance on expert judgement. More detailed assessment, including on ground assessment, would be needed to consider how these plans were developed and critically investigate their implementation, and also how the Paris Agreement guidelines are interpreted by different ministries and sectors and at different scales. Such plans are indeed important to institutions and organisations, and give good indications of priorities and institutional thinking. Many funders also base their investment decisions on national priorities found in these plans and in many ways such plans have a significant influence as to what gets funded and in which sectors. Also, these plans are in many cases the first generation of national adaptation plans for the countries, and there is a learning process for what is a relatively new idea. What should or should not be included and discussed in adaptation plans is still open for debate, and hopefully this study can inform that discussion. Certainly, later NAPAs and NAPs have benefited from the extensive UNFCCC adaptation planning process. As more countries develop NAPs, there is scope to not only repeat the analysis, but also to compare changes in adaptation plans.

6. Conclusions

This paper evaluates how national climate adaptation policy and planning processes are aligned to UNFCCC Paris Agreement commitments across different countries. We assessed 54 national adaptation plans and strategies using criteria derived from themes, guidance and elements articulated in the Paris Agreement. Our analysis shows that there is significant consistency in approaches to adaptation planning across these plans.

Importantly, most countries fail to include in their planning the ecological framing reflected in the Paris Agreement as a focus on economic and social vulnerability and resilience continues to dominate. While a greater emphasis on an ecological approach can raise concerns for development trade-offs, these can be often resolved by considering synergies and co-benefits such as those associated with ecosystem service benefits and opportunities for green growth (Munang et al., 2013a; Vincent, 2012). The move from NAPAs to NAPs should aim to include this ecological focus, and developed countries and the UNFCCC can support them in this by providing the necessary financial resources for the design and implementation of nature-based solutions. Developed countries also have the opportunity to show leadership in taking an ecological focus within their own plans as they are revised and updated.

The criteria developed provide an approach to assessing how well national adaptation plans align with key themes, guidance and elements of the Paris Agreement. This inferred comparative analysis reveals important differences between developed and developing countries. Besides highlighting the usefulness of the Paris Agreement guidelines to support countries in developing sound National Communications on adaptation (e.g. by explicitly addressing the vulnerability, adaptive capacity and resilience components and encouraging particpative approaches to planning), our study emphasizes two major complementary recommandations for enhancing such official contributions to the UNFCCC process:

- Better balance social/economic aspects with the environmental/ecological by ensuring ecosystem assessment, monitoring and enhancement are included in planning across all sectors; and
- Include explanations, as Annexes to the official submissions, of how the progress of implementing adaptation plans is assessed as part of the reporting in order to create better understanding what actions and processes countries have taken in fulfilling their reporting requirements.

Importantly, adaptation planning guided by international cooperation and mechanisms such as the Paris Agreement can help to ensure the continued mobilisation of the parties, guide adaptation planning nationally, and support global-scale consistency in planning and action.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.envsci.2018.10.012.

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